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CLAIMS

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[Claim(s)]

[Claim 1]Provide a transponder characterized by comprising the following which transmits a reply signal to said interrogator, and said interrogator, Based on magnetic-field-strength data contained in said received reply signal, an antenna for magnetic field generating which transmitted a magnetic field signal with which intensity serves as the maximum among magnetic field signals which said transponder received is judged, A wireless door lock release system for vehicles having the function to unlock a locking mechanism of a door corresponding to the antenna for magnetic field generating concerned, or a suitcase.

An interrogator which is provided with an antenna for magnetic field generating formed [ a door of vehicles, and near the suitcase / respectively ], and transmits a magnetic field signal of the same intensity from the antenna for magnetic field generating concerned.

Magnetic-field-strength data in which intensity of a magnetic field signal which was provided with a receiving antenna which carries out inductive coupling to said antenna for magnetic field generating for a short distance, and the receiving antenna concerned received is shown is obtained, and it is this magnetic-field-strength data.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the wireless door lock release system for vehicles which can unlock the locking mechanism of the door for which a user asks, or a suitcase without performing operation which inserts a key in a key hole.

[0002]

[Description of the Prior Art]When unlocking the locking mechanism of the door of vehicles, such as a car, in order to simplify troublesome operation in which a key must be inserted in a key hole each time, For example, a transmitter is built in an ignition key and there is composition which makes a radio wave signal send according to the operation to a manual operation button from this transmitter, and unlocks a locking mechanism by remote control.

[0003]In such composition, the control circuit and antenna for door-lock control are formed in the vehicles side. And if a user approaches vehicles and operates a transmitter, the radio wave signal having contained the identification code which discriminates self from a transmitter will be transmitted. Then, the above-mentioned radio wave signal is received from an antenna, the control circuit by the side of vehicles judges whether the identification code contained in the radio wave signal is in agreement with the identification code registered beforehand, and when in agreement, it unlocks a door lock system.

[0004]

[Problem(s) to be Solved by the Invention]Reception of the signal from a transmitter usually constitutes such a wireless door lock release system so that the locking mechanism of the door of a driver's seat may be made to unlock or the locking mechanism of all the doors and suitcases may be made to unlock.

[0005]However, since operation of inserting a key in a key hole was required to wish for a user to unlock the door and suitcase of a passenger seat in composition of unlocking the locking mechanism of the door of a driver's seat, it was still inconvenient. In composition of unlocking all the locking mechanisms, the locking failure after unlocking a locking mechanism arose, and there was a problem that security performance will fall.

[0006]Then, it is the composition of unlocking the door of a driver's seat and a passenger seat, and the locking mechanism of a suitcase, and a wireless door lock release system which can moreover unlock only the locking mechanism of the door for which a user asks, or a suitcase by remote control is desired. In this case, in order to raise operativity, the system which unlocks a locking mechanism automatically only by a user approaching vehicles is desirable.

[0007]This invention was made in light of the above-mentioned circumstances, and the purpose can unlock the locking mechanism of the door for which a user asks among the door of vehicles, and a suitcase, or a suitcase, and there is in moreover providing the wireless door lock release system which can improve user-friendliness.

[0008]

[Means for Solving the Problem]A wireless door lock release system for vehicles of this invention, An interrogator which is provided with an antenna for magnetic field generating formed [ a door of vehicles, and near the suitcase / respectively ], and transmits a magnetic field signal of the same intensity from the antenna for magnetic field generating concerned, Obtain magnetic-field-strength data in which intensity of a magnetic field signal which was provided with a receiving antenna which carries out inductive coupling to said antenna for magnetic field generating for a short distance, and the receiving antenna concerned received is shown, and provide a transponder which transmits a reply signal having contained this magnetic-field-strength data to said interrogator, and said interrogator, Based on

magnetic-field-strength data contained in said received reply signal, an antenna for magnetic field generating which transmitted a magnetic field signal with which intensity serves as the maximum among magnetic field signals which said transponder received is judged, It has the function to unlock a locking mechanism of a door corresponding to the antenna for magnetic field generating concerned, or a suitcase.

[0009]If a magnetic field signal is transmitted from the interrogator side according to such composition, a magnetic field signal of intensity according to distance with each antenna formed in a door and a suitcase of vehicles will be received, and a transponder will come to reply a reply signal having contained magnetic-field-strength data in which intensity of the magnetic field signal is shown. In this case, since the extinction ratio of signal strength to distance of a magnetic field signal is larger than that of a radio wave signal about 10 times, intensity of a magnetic field signal which a transponder receives comes to differ greatly according to distance with each antenna formed in transponder concerned and vehicles.

[0010]Therefore, the interrogator can judge correctly size of distance of each antenna and a transponder which were provided in vehicles based on magnetic-field-strength data contained in a reply signal from a transponder, and. Based on this judgment, a door or a suitcase in which a door corresponding to an antenna with the shortest distance with a transponder or a locking mechanism of a suitcase, i.e., a user, asks for unlocking can be unlocked. In this case, since unlocking of a locking mechanism is performed only to a door or a suitcase for which a user asks, unnecessary unlocking is not performed to other locking mechanisms, and security performances -- a locking failure can be prevented -- do not fall. And since operation in which a user pushes a specific switch in this case is unnecessary, it is user-friendly.

[0011]

[Embodiment of the Invention]Hereafter, the 1st example of this invention is described with reference to drawing 1 thru/or drawing 3. First, the combination of the functional block shows typically the entire configuration of the wireless door lock release system to drawing 1.

[0012]In this drawing 1, the wireless door lock release system for vehicles comprises the interrogator 12 provided in the vehicles (refer to drawing 2) 11 side, and the transponder 14 built in where unitization is carried out to the key grip of the ignition key (refer to drawing 2) 13.

[0013]First, the interrogator 12 is provided with the three coiled antennas 15-17 as an antenna for magnetic field generating, and is constituted. As shown in drawing 2, these three antennas 15-17 are formed [ the door of a driver's seat and a passenger seat, and near the suitcase ], and are hereafter called the D antenna 15, the P antenna 16, and T type antenna 17 in order of, respectively. In this case, although not illustrated in detail, each antennas 15-17 are allocated near each door and the outer handle of a suitcase, or the key cylinder.

[0014]The interrogator 12 is constituted considering the judging circuit 18 as a center. This judging circuit 18 is constituted by the microcomputer, for example, has a function as a controller which controls of operation [ of the interrogator 12 / at large ], and it has memorized the control program for it.

[0015]The transmission control of the magnetic field signal which led each above-mentioned antennas 15-17 has composition performed by the judging circuit 18. That is, a magnetic field signal is intermittently generated from the magnetic field signal generation circuit 19, and by carrying out switching operation of the switcher 20 for every predetermined time set up beforehand, the judging circuit 18 is constituted so that a magnetic field signal may be made to transmit in order from each antennas 15-17.

[0016]In this case, the magnetic field signal oscillated from each antennas 15-17 (transmission), As it is the same intensity, respectively and is shown in drawing 3, it comprises combination of the pulse P1 which shows a start, and the pulse P2 whose width is smaller than this pulse P1, and let time delay  $\Delta T$  from the pulse P1 of the pulse P2 be a value peculiar to each antennas 15-17.

[0017]On the other hand, it is constituted by the judging circuit 18 so that the reply signal from the transponder 14 may be inputted via the high frequency receiving circuit 21. Here, the reply signal replied from the transponder 14 is explained with the entire configuration of this transponder 14.

[0018]The transponder 14 was constituted considering the control circuit 22 as a center, and is provided with the coiled receiving antenna 23 which receives the magnetic field signal from the outside. The receiving antenna 23 carries out multiple connection of the coil 23a and the capacitor 23b between signal-line SL and a ground terminal, and is constituted between, By carrying out inductive coupling in the antennas 15-17 for magnetic field generating of the interrogator 12 and short distance which were

provided in the vehicles 11 side, for example, about 1 m, it is constituted so that the magnetic field signal from each antennas 15-17 may be received. [ less than ]

[0019]Therefore, since each antennas 15-17 are formed in the vehicles 11 side of 1 m or more apart, respectively, the receiving antenna 23 is constituted so that only the magnetic field signal from at most two antennas may be received. And the receiving antenna's 23 reception of the magnetic field signal from the interrogator 12 will input the magnetic field signal into the Wake rise circuit 24. And when the signal level of the inputted magnetic field signal exceeds default value, the Wake rise circuit 24 outputs a seizing signal to the control circuit 22, and changes it to an active state.

[0020]The receiving antenna's 23 reception of the magnetic field signal from the interrogator 12 will input this magnetic field signal into the processing circuit 25. And in the processing circuit 25, magnetic-field-strength data  $\delta B$  which shows the value corresponding to the signal level induced by said receiving antenna 23 with a magnetic field signal is generated, and it is constituted so that time delay data  $\delta T$  of the pulse P2 to the pulse P1 which constitutes a magnetic field signal may be obtained.

[0021]Then, magnetic-field-strength data  $\delta B$  and time delay data  $\delta T$  which were obtained in the processing circuit 25 are inputted into the control circuit 22. If ID identification code  $\delta A$  peculiar to the corresponding ignition key 13 is beforehand memorized in the control circuit 22 and said magnetic-field-strength data  $\delta B$  and time delay data  $\delta T$  are inputted, It is constituted so that magnetic-field-strength data  $\delta B$  may be coded and outputted in order of the frame corresponding to time delay  $\delta T$  after said ID identification code  $\delta A$  in the coding circuit 26.

[0022]That is, magnetic-field-strength data  $\delta B$  is outputted with the 1st data output frame that follows ID identification code  $\delta A$  when time until it receives the pulse P2 after the pulse P1 is  $\delta T_1$ , Magnetic-field-strength data  $\delta B$  is outputted with the 2nd data output frame that follows ID identification code  $\delta A$  when time until it receives the pulse P2 after the pulse P1 is  $\delta T_2$ , When time until it receives the pulse P2 after the pulse P1 is  $\delta T_3$ , magnetic-field-strength data  $\delta B$  is outputted with the 3rd data output frame following ID identification code  $\delta A$ .

[0023]And the high frequency transmitting circuit 27 is constituted so that the high frequency signal (reply signal) modulated based on the output of the coding circuit 26 may be transmitted from the reply antenna 28 (reply).

[0024]On the other hand, in the interrogator 12, if a reply signal is transmitted from the reply antenna 28, this reply signal will be incorporated into the high frequency receiving circuit 21 via the receiving antenna 29 by the side of the vehicles 11, and will be inputted into the judging circuit 18. In the judging circuit 18, the same ID identification code  $\delta A$  as ID identification code  $\delta A$  memorized as the object for cars concerned in the control circuit 22 by the side of the ignition key 13 is memorized.

[0025]It is judged whether the judging circuit 18 decodes a reply signal and its ID identification code  $\delta A$  beforehand remembered to be ID identification code  $\delta A$  contained in this reply signal in the judging circuit 18 corresponds. When both are in agreement, based on magnetic-field-strength data  $\delta B$  contained in a reply signal, and its order of a data frame, the judging circuit 18, Among the magnetic field signals which the transponder 14 received, intensity judges the antenna which transmitted the magnetic field signal used as the maximum, and gives the decision result  $S_a$  to the drive circuit 30.

[0026]When the magnetic field strength of the direction which shows a value large when two or more kinds magnetic-field-strength data  $\delta B$  is contained in a reply signal in this example is more than a predetermined level, When 1 kind of magnetic-field-strength data  $\delta B$  is contained and the magnetic field strength is more than a predetermined level, When it is the magnetic field strength of the magnetic field signal received when the transponder 14 was specifically located in less than about 50-cm area from an antenna, the judging circuit 18 is constituted so that an antenna may be judged from the order of a data frame of the magnetic-field-strength data  $\delta B$ .

[0027]The locking mechanism unlocking command signal  $S_b$  for unlocking the locking mechanism 31 of the door corresponding to the antenna or a suitcase is given by this to the electric actuator of the locking mechanism 31, It is constituted so that the energization drive of the electromagnet for lock release of this electric actuator may be carried out and unlock operation of the locking mechanism may be carried out. And if rotational operation of the outer handle is carried out where the locking mechanism 31 is unlocked, the ratchet mechanism holding the eyelid completely closure of a door and a suitcase will separate, and, as for the door and suitcase of a driver's seat and a passenger seat, a door or a suitcase will be opened wide. If specified time elapse of each door and the suitcase is carried out without carrying out rotational operation of the outer handle after a locking mechanism is unlocked, they will be locked automatically.

[0028]Now, the operation in the case of approaching the vehicles 11 in an operation of the above-mentioned composition that a user should unlock the door of a driver's seat is mentioned as an example, and is explained. In this case, when the user has approached the driver's seat from the side side of the vehicles 11 thru/or the front (it is the upper part thru/or on the left-hand side of the vehicles 11 in drawing 2), and when the user has approached the driver's seat from the back (setting to drawing 2 the right-hand side side of the vehicles 11 thru/or the upper right side) of the vehicles 11, it divides and explains.

[0029]First, the magnetic field signal is sent to the vehicles 11 side in order from each antennas 15-17. That is, the judging circuit 18 operates the magnetic field signal generation circuit 19 intermittently, and the magnetic field signal of the same intensity that consists of combination of the pulse P1 and the pulse P2 as shown in drawing 3 is sent from each antennas 15-17 by carrying out switching operation of the switcher 20.

[0030]At this time, time delay  $\Delta T$  from the pulse P1 of the pulse P2 in the magnetic field signal transmitted from each antennas 15-17 is made into the peculiar value, and, respectively specifically, The time delay [ in / to  $\Delta T_2$  / in the time delay in the magnetic field signal of the P antenna 16 / the magnetic field signal of T type antenna 15 ] lets the time delay in the magnetic field signal of the D antenna 15 be  $\Delta T_3 \Delta T_1$ . A magnetic field signal is continuously transmitted in order of the D antenna 15, the P antenna 16, and T type antenna 17, and after the n-th magnetic field signal is transmitted from each antennas 15-17, predetermined time is set and the n+1st magnetic field signals come to be transmitted.

[0031]And first, when the user has approached the driver's seat from the side side of the vehicles 11 thru/or the front (it is the upper part thru/or on the left-hand side of the vehicles 11 in drawing 2), if a user (ignition key 13) enters in less than about 1-m area from the D antenna 15, The receiving antenna 23 of the transponder 14 receives a magnetic field signal by carrying out inductive coupling to the D antenna 15. Thereby, in the transponder 14, as mentioned above, the control circuit 22 responds for switching to an active state by the Wake rise circuit 24, and magnetic-field-strength data  $\Delta B$  and the time delay data  $\Delta T_1$  corresponding to the magnetic field signal from the D antenna 15 are inputted into the control circuit 22.

[0032]In the control circuit 22, after ID identification code  $\Delta A$  memorized beforehand, magnetic-field-strength data  $\Delta B$  is coded by the coding circuit 26, and is outputted by the prescribed timing based on the time delay data  $\Delta T_1$ . And the high frequency transmitting circuit 27 creates a reply signal based on the output of the coding circuit 26, and replies it from the reply antenna 28 (transmission).

[0033]By the way, in [ since the magnetic field signal is transmitted in order via all the antennas 15-17 from the interrogator 12 by the side of the vehicles 11 for every predetermined time ] the transponder 14, After the pulse P1 is inputted, whenever it carries out specified time elapse, the reply signal corresponding to the received magnetic field signal is created.

[0034]And in the interrogator 12 by the side of the vehicles 11, after receiving the reply signal from the above-mentioned transponder 14 via the receiving antenna 29 and getting over in the high frequency receiving circuit 27, it decodes in the discrimination circuit 18. The discrimination circuit 18 forbids unlocking of all the locking mechanisms 31, when ID identification code  $\Delta A$  contained in a reply signal is compared with ID identification code  $\Delta A$  memorized beforehand in the discrimination circuit 18 and both are not in agreement.

[0035]Therefore, since neither of the locking mechanisms 31 of the vehicles 11 is unlocked even if the user holding the un-proper ignition key whose ID identification code does not correspond approaches, the security performance to a theft does not fall.

[0036]When ID identification code  $\Delta A$  beforehand remembered to be ID identification code  $\Delta A$  contained in a reply signal on the other hand in the discrimination circuit 18 is in agreement, the discrimination circuit 18 judges whether the intensity level of magnetic-field-strength data  $\Delta B$  contained in a reply signal has reached the predetermined level. And when the intensity level of magnetic-field-strength data  $\Delta B$  had not reached a predetermined level, i.e., a user receives a magnetic field signal out of less than about 50-cm area from the D antenna 15, it waits to end operation and to input the following reply signal.

[0037]On the other hand, when a user is located in less than about 50-cm area from the D antenna 15 and the intensity level of magnetic-field-strength data  $\Delta B$  has reached the predetermined level, the discrimination circuit 18, A magnetic field signal judges with it being a magnetic field signal from the D

antenna 15 based on the input timing of magnetic field signal data  $\Delta B$  which it is transmitted of each antennas 15-17 either, or is contained in a reply signal, and gives the decision result  $S_a$  to the drive circuit 30. And the drive circuit 30 gives the lock release command signal  $S_b$  of which the lock of the door of a driver's seat is canceled based on the decision result  $S_a$  to the electric actuator of the locking mechanism 31, and, thereby, unlock operation of the locking mechanism 31 of the door of a driver's seat is carried out.

[0038]Next, the case where the user has approached the driver's seat from the back (setting to drawing 2 the right-hand side side of the vehicles 11 thru/or the upper right side) of the vehicles 11 is explained. First, when a user (ignition key 13) is located in less than 1-m area from both the D antenna 15 and T type antenna 17, the receiving antenna 23 of the transponder 14 receives a magnetic field signal from both by carrying out inductive coupling to the D antenna 15 and T type antenna 17.

[0039]Thereby, in the transponder 14 side, a reply signal is created based on ID identification code  $\Delta A$ , magnetic-field-strength data  $\Delta B$  corresponding to the D antenna 15, and magnetic-field-strength data  $\Delta B$  corresponding to T type antenna 17, and it sends a reply from the reply antenna 28.

[0040]And in the interrogator 12 by the side of the vehicles 11, it is received via the receiving antenna 29 and the reply signal from the transponder 14 is decoded in the discrimination circuit 18. When ID identification code  $\Delta A$  contained in a reply signal and ID identification code  $\Delta A$  memorized beforehand in the discrimination circuit 18 are not in agreement at this time, the discrimination circuit 18 forbids unlocking of all the locking mechanisms 31, as mentioned above.

[0041]When ID identification code  $\Delta A$  beforehand remembered to be ID identification code  $\Delta A$  contained in a reply signal on the other hand in the discrimination circuit 18 is in agreement, the discrimination circuit 18 judges whether the intensity level of the direction which shows a large value among magnetic-field-strength data  $\Delta B$  contained in a reply signal has reached the predetermined level. In this case, a user is not located in the D antenna 15 and T type antenna [ 17 / either / less than about 50 cm of ] area, if it is and puts in another way from both the D antenna 15 and T type antenna 17 in the position (namely, less than about 1 m) which receives a magnetic field signal. Therefore, since all intensity levels of magnetic-field-strength data  $\Delta B$  corresponding to the magnetic field signal from both the antennas 15 and 17 have reached the predetermined level, they will end operation and will wait for the following reply signal.

[0042]And since it is not located in less than about 1-m area from T type antenna 17 in this case when a user approaches a driver's seat and is located in less than about 50-cm area from the D antenna 15, as for the receiving antenna 23 of the transponder 14, only the magnetic field signal from the D antenna 15 is received. Then, the transponder 14 creates and replies a reply signal based on ID identification code  $\Delta A$  and magnetic-field-strength data  $\Delta B$  corresponding to the magnetic field signal from the D antenna 15. As a result, the locking mechanism 31 of the door of a driver's seat is similarly unlocked with having mentioned above.

[0043]When a user asked for unlocking of the door of a driver's seat, explained operation in case only the door of a driver's seat is unlocked here, but. Since it will be automatically locked if specified time elapse is carried out without carrying out rotational operation of the outer handle even if the door and suitcase of a passenger seat for which a user does not ask even if may be unlocked, it excels in the field of security.

[0044]According to this example of such composition, the antennas 15-17 are formed an outer handle or near a key cylinder the door of the driver's seat of the vehicles 11, and a passenger seat, and a suitcase, respectively, When the transponder 14 is located in less than about 1-m area from these antennas 15-17, Transmit the reply signal which the transponder 14 received the magnetic field signal of the intensity according to the distance from each antennas 15-17, created magnetic-field-strength data  $\Delta B$ , and contained this magnetic-field-strength data  $\Delta B$ , and. Based on magnetic-field-strength data  $\Delta B$  contained in the reply signal replied from the transponder 14, the interrogator 12, Since it constituted so that an antenna with the shortest distance with the transponder 14 might be judged correctly and only the door or suitcase corresponding to this antenna for which a user asks might be unlocked, Since unnecessary lock release is not performed unlike the case where all the locking mechanisms are unlocked, security performances -- a locking failure can be prevented -- improve.

[0045]And since it constituted so that the door lock system 31 might be unlocked when the transponder 14 received the magnetic field signal from the vehicles 11 side and the transponder 14 was located in less than about 50-cm area from the D antenna 15, A user can judge correctly the door etc. which ask

for lock release, and the locking mechanism 31 can be prevented from unlocking carelessly.

[0046]And without carrying out operation of pushing a specific switch, since the locking mechanism 31 is unlocked only by approaching the vehicles 11, a user's user-friendliness improves. Since the interrogator 12 will receive the reply signal (radio wave signal) from the transponder 14 for a short distance comparatively, it can lessen influence of noises, such as a communication radio wave to a reply signal, as much as possible.

[0047]Drawing 4 shows the 2nd example of this invention, and explains a different place from the 1st example. That is, it comprises this example so that the magnetic field signal from each antennas 15-17 for magnetic field generating may set a predetermined interval and may be intermittently transmitted in the interrogator 12. And as a magnetic field signal is shown in drawing 4 in this example, it is transmitted in order of the D antenna 15, the P antenna 16, and T type antenna 17, and each magnetic field signal is the same intensity, and comprises the single pulse P3.

[0048]On the other hand, whenever it receives a magnetic field signal from the interrogator 12, the transponder 14 generates the reply signal having contained ID identification code deltaA beforehand remembered to be magnetic-field-strength data deltaB about the magnetic field signal in the control circuit 22, and it is constituted so that it may send a reply from the reply antenna 28.

[0049]And in the interrogator 12 by the side of the vehicles 11, Compare ID identification code deltaA which receives the reply signal from the transponder 14 and is contained in the reply signal with ID identification code deltaA memorized beforehand in the discrimination circuit 18, and. When both are in agreement, it is distinguished whether based on magnetic-field-strength data deltaB, the intensity of the magnetic field signal which the transponder 14 received has reached the predetermined intensity level.

[0050]It is constituted so that the reply signal from the transponder 14 may be received, by the time it transmits the following magnetic field signal, after the interrogator 12 transmits a magnetic field signal at this time. Thereby, the interrogator 12 can identify whether the reply signal from the transponder 14 is a thing corresponding to the magnetic field signal from which antennas 15-17. Therefore, also in this example, the same operation effect as the 1st example of the above can be obtained.

[0051]Expansion or change which it is not limited to the above-mentioned example and described below is possible for this invention. The reply signal from the transponder 14 is good also as not only a radio wave signal but a magnetic field signal, or a lightwave signal. Although the receiving antenna 23 and the reply antenna 28 were separately formed in the transponder 14, respectively, it is good also as the same antenna.

[0052]

[Effect of the Invention]When a magnetic field signal is transmitted from the interrogator side according to the wireless door lock release system for vehicles of this invention so that clearly from the above explanation, a transponder, Reply the reply signal having contained the magnetic-field-strength data which receives the magnetic field signal of the intensity according to distance with each antenna formed in the door and suitcase of vehicles, and in which the intensity of the magnetic field signal is shown, and. Since the interrogator unlocked only the door lock system of the door corresponding to an antenna with the shortest distance with a transponder, or the suitcase based on the magnetic-field-strength data contained in the received reply signal, Unnecessary unlocking of a locking mechanism is not performed and security performances -- a locking failure can be prevented -- improve. And since operation in which a user pushes a specific switch in this case is unnecessary, the outstanding effect that user-friendliness can be improved is done so.

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**TECHNICAL FIELD**

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[Field of the Invention]This invention relates to the wireless door lock release system for vehicles which can unlock the locking mechanism of the door for which a user asks, or a suitcase without performing operation which inserts a key in a key hole.

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PRIOR ART

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[Description of the Prior Art]When unlocking the locking mechanism of the door of vehicles, such as a car, in order to simplify troublesome operation in which a key must be inserted in a key hole each time, For example, a transmitter is built in an ignition key and there is composition which makes a radio wave signal send according to the operation to a manual operation button from this transmitter, and unlocks a locking mechanism by remote control.

[0003]In such composition, the control circuit and antenna for door-lock control are formed in the vehicles side. And if a user approaches vehicles and operates a transmitter, the radio wave signal having contained the identification code which discriminates self from a transmitter will be transmitted. Then, the above-mentioned radio wave signal is received from an antenna, the control circuit by the side of vehicles judges whether the identification code contained in the radio wave signal is in agreement with the identification code registered beforehand, and when in agreement, it unlocks a door lock system.

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EFFECT OF THE INVENTION

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[Effect of the Invention]When a magnetic field signal is transmitted from the interrogator side according to the wireless door lock release system for vehicles of this invention so that clearly from the above explanation, a transponder, Reply the reply signal having contained the magnetic-field-strength data which receives the magnetic field signal of the intensity according to distance with each antenna formed in the door and suitcase of vehicles, and in which the intensity of the magnetic field signal is shown, and. Since the interrogator unlocked only the door lock system of the door corresponding to an antenna with the shortest distance with a transponder, or the suitcase based on the magnetic-field-strength data contained in the received reply signal, Unnecessary unlocking of a locking mechanism is not performed and security performances -- a locking failure can be prevented -- improve. And since operation in which a user pushes a specific switch in this case is unnecessary, the outstanding effect that user-friendliness can be improved is done so.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention]Reception of the signal from a transmitter usually constitutes such a wireless door lock release system so that the locking mechanism of the door of a driver's seat may be made to unlock or the locking mechanism of all the doors and suitcases may be made to unlock. [0005]However, since operation of inserting a key in a key hole was required to wish for a user to unlock the door and suitcase of a passenger seat in composition of unlocking the locking mechanism of the door of a driver's seat, it was still inconvenient. In composition of unlocking all the locking mechanisms, the locking failure after unlocking a locking mechanism arose, and there was a problem that security performance will fall.

[0006]Then, it is the composition of unlocking the door of a driver's seat and a passenger seat, and the locking mechanism of a suitcase, and a wireless door lock release system which can moreover unlock only the locking mechanism of the door for which a user asks, or a suitcase by remote control is desired. In this case, in order to raise operativity, the system which unlocks a locking mechanism automatically only by a user approaching vehicles is desirable.

[0007]This invention was made in light of the above-mentioned circumstances, and the purpose can unlock the locking mechanism of the door for which a user asks among the door of vehicles, and a suitcase, or a suitcase, and there is in moreover providing the wireless door lock release system which can improve user-friendliness.

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MEANS

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[Means for Solving the Problem]A wireless door lock release system for vehicles of this invention, An interrogator which is provided with an antenna for magnetic field generating formed [ a door of vehicles, and near the suitcase / respectively ], and transmits a magnetic field signal of the same intensity from the antenna for magnetic field generating concerned, Obtain magnetic-field-strength data in which intensity of a magnetic field signal which was provided with a receiving antenna which carries out inductive coupling to said antenna for magnetic field generating for a short distance, and the receiving antenna concerned received is shown, and provide a transponder which transmits a reply signal having contained this magnetic-field-strength data to said interrogator, and said interrogator, Based on magnetic-field-strength data contained in said received reply signal, an antenna for magnetic field generating which transmitted a magnetic field signal with which intensity serves as the maximum among magnetic field signals which said transponder received is judged, It has the function to unlock a locking mechanism of a door corresponding to the antenna for magnetic field generating concerned, or a suitcase.

[0009]If a magnetic field signal is transmitted from the interrogator side according to such composition, a magnetic field signal of intensity according to distance with each antenna formed in a door and a suitcase of vehicles will be received, and a transponder will come to reply a reply signal having contained magnetic-field-strength data in which intensity of the magnetic field signal is shown. In this case, since the extinction ratio of signal strength to distance of a magnetic field signal is larger than that of a radio wave signal about 10 times, intensity of a magnetic field signal which a transponder receives comes to differ greatly according to distance with each antenna formed in transponder concerned and vehicles.

[0010]Therefore, the interrogator can judge correctly size of distance of each antenna and a transponder which were provided in vehicles based on magnetic-field-strength data contained in a reply signal from a transponder, and. Based on this judgment, a door or a suitcase in which a door corresponding to an antenna with the shortest distance with a transponder or a locking mechanism of a suitcase, i.e., a user, asks for unlocking can be unlocked. In this case, since unlocking of a locking mechanism is performed only to a door or a suitcase for which a user asks, unnecessary unlocking is not performed to other locking mechanisms, and security performances -- a locking failure can be prevented -- do not fall. And since operation in which a user pushes a specific switch in this case is unnecessary, it is user-friendly.

[0011]

[Embodiment of the Invention]Hereafter, the 1st example of this invention is described with reference to drawing 1 thru/or drawing 3. First, the combination of the functional block shows typically the entire configuration of the wireless door lock release system to drawing 1.

[0012]In this drawing 1, the wireless door lock release system for vehicles comprises the interrogator 12 provided in the vehicles (refer to drawing 2) 11 side, and the transponder 14 built in where unitization is carried out to the key grip of the ignition key (refer to drawing 2) 13.

[0013]First, the interrogator 12 is provided with the three coiled antennas 15-17 as an antenna for magnetic field generating, and is constituted. As shown in drawing 2, these three antennas 15-17 are formed [ the door of a driver's seat and a passenger seat, and near the suitcase ], and are hereafter called the D antenna 15, the P antenna 16, and T type antenna 17 in order of, respectively. In this case, although not illustrated in detail, each antennas 15-17 are allocated near each door and the outer handle of a suitcase, or the key cylinder.

[0014]The interrogator 12 is constituted considering the judging circuit 18 as a center. This judging circuit 18 is constituted by the microcomputer, for example, has a function as a controller which

controls of operation [ of the interrogator 12 / at large ], and it has memorized the control program for it.

[0015]The transmission control of the magnetic field signal which led each above-mentioned antennas 15-17 has composition performed by the judging circuit 18. That is, a magnetic field signal is intermittently generated from the magnetic field signal generation circuit 19, and by carrying out switching operation of the switcher 20 for every predetermined time set up beforehand, the judging circuit 18 is constituted so that a magnetic field signal may be made to transmit in order from each antennas 15-17.

[0016]In this case, the magnetic field signal oscillated from each antennas 15-17 (transmission), As it is the same intensity, respectively and is shown in drawing 3, it comprises combination of the pulse P1 which shows a start, and the pulse P2 whose width is smaller than this pulse P1, and let time delay  $\Delta T$  from the pulse P1 of the pulse P2 be a value peculiar to each antennas 15-17.

[0017]On the other hand, it is constituted by the judging circuit 18 so that the reply signal from the transponder 14 may be inputted via the high frequency receiving circuit 21. Here, the reply signal replied from the transponder 14 is explained with the entire configuration of this transponder 14.

[0018]The transponder 14 was constituted considering the control circuit 22 as a center, and is provided with the coiled receiving antenna 23 which receives the magnetic field signal from the outside. The receiving antenna 23 carries out multiple connection of the coil 23a and the capacitor 23b between signal-line SL and a ground terminal, and is constituted between, By carrying out inductive coupling in the antennas 15-17 for magnetic field generating of the interrogator 12 and short distance which were provided in the vehicles 11 side, for example, about 1 m, it is constituted so that the magnetic field signal from each antennas 15-17 may be received. [ less than ]

[0019]Therefore, since each antennas 15-17 are formed in the vehicles 11 side of 1 m or more apart, respectively, the receiving antenna 23 is constituted so that only the magnetic field signal from at most two antennas may be received. And the receiving antenna's 23 reception of the magnetic field signal from the interrogator 12 will input the magnetic field signal into the Wake rise circuit 24. And when the signal level of the inputted magnetic field signal exceeds default value, the Wake rise circuit 24 outputs a seizing signal to the control circuit 22, and changes it to an active state.

[0020]The receiving antenna's 23 reception of the magnetic field signal from the interrogator 12 will input this magnetic field signal into the processing circuit 25. And in the processing circuit 25, magnetic-field-strength data  $\Delta B$  which shows the value corresponding to the signal level induced by said receiving antenna 23 with a magnetic field signal is generated, and it is constituted so that time delay data  $\Delta T$  of the pulse P2 to the pulse P1 which constitutes a magnetic field signal may be obtained.

[0021]Then, magnetic-field-strength data  $\Delta B$  and time delay data  $\Delta T$  which were obtained in the processing circuit 25 are inputted into the control circuit 22. If ID identification code  $\Delta A$  peculiar to the corresponding ignition key 13 is beforehand memorized in the control circuit 22 and said magnetic-field-strength data  $\Delta B$  and time delay data  $\Delta T$  are inputted, It is constituted so that magnetic-field-strength data  $\Delta B$  may be coded and outputted in order of the frame corresponding to time delay  $\Delta T$  after said ID identification code  $\Delta A$  in the coding circuit 26.

[0022]That is, magnetic-field-strength data  $\Delta B$  is outputted with the 1st data output frame that follows ID identification code  $\Delta A$  when time until it receives the pulse P2 after the pulse P1 is  $\Delta T_1$ , Magnetic-field-strength data  $\Delta B$  is outputted with the 2nd data output frame that follows ID identification code  $\Delta A$  when time until it receives the pulse P2 after the pulse P1 is  $\Delta T_2$ , When time until it receives the pulse P2 after the pulse P1 is  $\Delta T_3$ , magnetic-field-strength data  $\Delta B$  is outputted with the 3rd data output frame following ID identification code  $\Delta A$ .

[0023]And the high frequency transmitting circuit 27 is constituted so that the high frequency signal (reply signal) modulated based on the output of the coding circuit 26 may be transmitted from the reply antenna 28 (reply).

[0024]On the other hand, in the interrogator 12, if a reply signal is transmitted from the reply antenna 28, this reply signal will be incorporated into the high frequency receiving circuit 21 via the receiving antenna 29 by the side of the vehicles 11, and will be inputted into the judging circuit 18. In the judging circuit 18, the same ID identification code  $\Delta A$  as ID identification code  $\Delta A$  memorized as the object for cars concerned in the control circuit 22 by the side of the ignition key 13 is memorized.

[0025]It is judged whether the judging circuit 18 decodes a reply signal and its ID identification code  $\Delta A$  beforehand remembered to be ID identification code  $\Delta A$  contained in this reply signal in the judging circuit 18 corresponds. When both are in agreement, based on magnetic-field-strength data

deltaB contained in a reply signal, and its order of a data frame, the judging circuit 18, Among the magnetic field signals which the transponder 14 received, intensity judges the antenna which transmitted the magnetic field signal used as the maximum, and gives the decision result Sa to the drive circuit 30. [0026]When the magnetic field strength of the direction which shows a value large when two or more kinds magnetic-field-strength data deltaB is contained in a reply signal in this example is more than a predetermined level, When 1 kind of magnetic-field-strength data deltaB is contained and the magnetic field strength is more than a predetermined level, When it is the magnetic field strength of the magnetic field signal received when the transponder 14 was specifically located in less than about 50-cm area from an antenna, the judging circuit 18 is constituted so that an antenna may be judged from the order of a data frame of the magnetic-field-strength data deltaB.

[0027]The locking mechanism unlocking command signal Sb for unlocking the locking mechanism 31 of the door corresponding to the antenna or a suitcase is given by this to the electric actuator of the locking mechanism 31, It is constituted so that the energization drive of the electromagnet for lock release of this electric actuator may be carried out and unlock operation of the locking mechanism may be carried out. And if rotational operation of the outer handle is carried out where the locking mechanism 31 is unlocked, the ratchet mechanism holding the eyelid completely closure of a door and a suitcase will separate, and, as for the door and suitcase of a driver's seat and a passenger seat, a door or a suitcase will be opened wide. If specified time elapse of each door and the suitcase is carried out without carrying out rotational operation of the outer handle after a locking mechanism is unlocked, they will be locked automatically.

[0028]Now, the operation in the case of approaching the vehicles 11 in an operation of the above-mentioned composition that a user should unlock the door of a driver's seat is mentioned as an example, and is explained. In this case, when the user has approached the driver's seat from the side side of the vehicles 11 thru/or the front (it is the upper part thru/or on the left-hand side of the vehicles 11 in drawing 2), and when the user has approached the driver's seat from the back (setting to drawing 2 the right-hand side side of the vehicles 11 thru/or the upper right side) of the vehicles 11, it divides and explains.

[0029]First, the magnetic field signal is sent to the vehicles 11 side in order from each antennas 15-17. That is, the judging circuit 18 operates the magnetic field signal generation circuit 19 intermittently, and the magnetic field signal of the same intensity that consists of combination of the pulse P1 and the pulse P2 as shown in drawing 3 is sent from each antennas 15-17 by carrying out switching operation of the switcher 20.

[0030]At this time, time delay deltaT from the pulse P1 of the pulse P2 in the magnetic field signal transmitted from each antennas 15-17 is made into the peculiar value, and, respectively specifically, The time delay [ in / to deltaT2 / in the time delay in the magnetic field signal of the P antenna 16 / the magnetic field signal of T type antenna 15 ] lets the time delay in the magnetic field signal of the D antenna 15 be deltaT3 deltaT1. A magnetic field signal is continuously transmitted in order of the D antenna 15, the P antenna 16, and T type antenna 17, and after the n-th magnetic field signal is transmitted from each antennas 15-17, predetermined time is set and the n+1st magnetic field signals come to be transmitted.

[0031]And first, when the user has approached the driver's seat from the side side of the vehicles 11 thru/or the front (it is the upper part thru/or on the left-hand side of the vehicles 11 in drawing 2), if a user (ignition key 13) enters in less than about 1-m area from the D antenna 15, The receiving antenna 23 of the transponder 14 receives a magnetic field signal by carrying out inductive coupling to the D antenna 15. Thereby, in the transponder 14, as mentioned above, the control circuit 22 responds for switching to an active state by the Wake rise circuit 24, and magnetic-field-strength data deltaB and the time delay data deltaT1 corresponding to the magnetic field signal from the D antenna 15 are inputted into the control circuit 22.

[0032]In the control circuit 22, after ID identification code deltaA memorized beforehand, magnetic-field-strength data deltaB is coded by the coding circuit 26, and is outputted by the prescribed timing based on the time delay data deltaT1. And the high frequency transmitting circuit 27 creates a reply signal based on the output of the coding circuit 26, and replies it from the reply antenna 28 (transmission).

[0033]By the way, in [ since the magnetic field signal is transmitted in order via all the antennas 15-17 from the interrogator 12 by the side of the vehicles 11 for every predetermined time ] the transponder 14, After the pulse P1 is inputted, whenever it carries out specified time elapse, the reply signal

corresponding to the received magnetic field signal is created.

[0034]And in the interrogator 12 by the side of the vehicles 11, after receiving the reply signal from the above-mentioned transponder 14 via the receiving antenna 29 and getting over in the high frequency receiving circuit 27, it decodes in the discrimination circuit 18. The discrimination circuit 18 forbids unlocking of all the locking mechanisms 31, when ID identification code deltaA contained in a reply signal is compared with ID identification code deltaA memorized beforehand in the discrimination circuit 18 and both are not in agreement.

[0035]Therefore, since neither of the locking mechanisms 31 of the vehicles 11 is unlocked even if the user holding the un-proper ignition key whose ID identification code does not correspond approaches, the security performance to a theft does not fall.

[0036]When ID identification code deltaA beforehand remembered to be ID identification code deltaA contained in a reply signal on the other hand in the discrimination circuit 18 is in agreement, the discrimination circuit 18 judges whether the intensity level of magnetic-field-strength data deltaB contained in a reply signal has reached the predetermined level. And when the intensity level of magnetic-field-strength data deltaB had not reached a predetermined level, i.e., a user receives a magnetic field signal out of less than about 50-cm area from the D antenna 15, it waits to end operation and to input the following reply signal.

[0037]On the other hand, when a user is located in less than about 50-cm area from the D antenna 15 and the intensity level of magnetic-field-strength data deltaB has reached the predetermined level, the discrimination circuit 18, A magnetic field signal judges with it being a magnetic field signal from the D antenna 15 based on the input timing of magnetic field signal data deltaB which it is transmitted of each antennas 15-17 either, or is contained in a reply signal, and gives the decision result Sa to the drive circuit 30. And the drive circuit 30 gives the lock release command signal Sb of which the lock of the door of a driver's seat is canceled based on the decision result Sa to the electric actuator of the locking mechanism 31, and, thereby, unlock operation of the locking mechanism 31 of the door of a driver's seat is carried out.

[0038]Next, the case where the user has approached the driver's seat from the back (setting to drawing 2 the right-hand side side of the vehicles 11 thru/or the upper right side) of the vehicles 11 is explained. First, when a user (ignition key 13) is located in less than 1-m area from both the D antenna 15 and T type antenna 17, the receiving antenna 23 of the transponder 14 receives a magnetic field signal from both by carrying out inductive coupling to the D antenna 15 and T type antenna 17.

[0039]Thereby, in the transponder 14 side, a reply signal is created based on ID identification code deltaA, magnetic-field-strength data deltaB corresponding to the D antenna 15, and magnetic-field-strength data deltaB corresponding to T type antenna 17, and it sends a reply from the reply antenna 28.

[0040]And in the interrogator 12 by the side of the vehicles 11, it is received via the receiving antenna 29 and the reply signal from the transponder 14 is decoded in the discrimination circuit 18. When ID identification code deltaA contained in a reply signal and ID identification code deltaA memorized beforehand in the discrimination circuit 18 are not in agreement at this time, the discrimination circuit 18 forbids unlocking of all the locking mechanisms 31, as mentioned above.

[0041]When ID identification code deltaA beforehand remembered to be ID identification code deltaA contained in a reply signal on the other hand in the discrimination circuit 18 is in agreement, the discrimination circuit 18 judges whether the intensity level of the direction which shows a large value among magnetic-field-strength data deltaB contained in a reply signal has reached the predetermined level. In this case, a user is not located in the D antenna 15 and T type antenna [ 17 / either / less than about 50 cm of ] area, if it is and puts in another way from both the D antenna 15 and T type antenna 17 in the position (namely, less than about 1 m) which receives a magnetic field signal. Therefore, since all intensity levels of magnetic-field-strength data deltaB corresponding to the magnetic field signal from both the antennas 15 and 17 have reached the predetermined level, they will end operation and will wait for the following reply signal.

[0042]And since it is not located in less than about 1-m area from T type antenna 17 in this case when a user approaches a driver's seat and is located in less than about 50-cm area from the D antenna 15, as for the receiving antenna 23 of the transponder 14, only the magnetic field signal from the D antenna 15 is received. Then, the transponder 14 creates and replies a reply signal based on ID identification code deltaA and magnetic-field-strength data deltaB corresponding to the magnetic field signal from the D antenna 15. As a result, the locking mechanism 31 of the door of a driver's seat is similarly unlocked

with having mentioned above.

[0043]When a user asked for unlocking of the door of a driver's seat, explained operation in case only the door of a driver's seat is unlocked here, but. Since it will be automatically locked if specified time elapse is carried out without carrying out rotational operation of the outer handle even if the door and suitcase of a passenger seat for which a user does not ask even if may be unlocked, it excels in the field of security.

[0044]According to this example of such composition, the antennas 15-17 are formed an outer handle or near a key cylinder the door of the driver's seat of the vehicles 11, and a passenger seat, and a suitcase, respectively, When the transponder 14 is located in less than about 1-m area from these antennas 15-17, Transmit the reply signal which the transponder 14 received the magnetic field signal of the intensity according to the distance from each antennas 15-17, created magnetic-field-strength data  $\Delta B$ , and contained this magnetic-field-strength data  $\Delta B$ , and. Based on magnetic-field-strength data  $\Delta B$  contained in the reply signal replied from the transponder 14, the interrogator 12, Since it constituted so that an antenna with the shortest distance with the transponder 14 might be judged correctly and only the door or suitcase corresponding to this antenna for which a user asks might be unlocked, Since unnecessary lock release is not performed unlike the case where all the locking mechanisms are unlocked, security performances -- a locking failure can be prevented -- improve.

[0045]And since it constituted so that the door lock system 31 might be unlocked when the transponder 14 received the magnetic field signal from the vehicles 11 side and the transponder 14 was located in less than about 50-cm area from the D antenna 15, A user can judge correctly the door etc. which ask for lock release, and the locking mechanism 31 can be prevented from unlocking carelessly.

[0046]And without carrying out operation of pushing a specific switch, since the locking mechanism 31 is unlocked only by approaching the vehicles 11, a user's user-friendliness improves. Since the interrogator 12 will receive the reply signal (radio wave signal) from the transponder 14 for a short distance comparatively, it can lessen influence of noises, such as a communication radio wave to a reply signal, as much as possible.

[0047]Drawing 4 shows the 2nd example of this invention, and explains a different place from the 1st example. That is, it comprises this example so that the magnetic field signal from each antennas 15-17 for magnetic field generating may set a predetermined interval and may be intermittently transmitted in the interrogator 12. And as a magnetic field signal is shown in drawing 4 in this example, it is transmitted in order of the D antenna 15, the P antenna 16, and T type antenna 17, and each magnetic field signal is the same intensity, and comprises the single pulse P3.

[0048]On the other hand, whenever it receives a magnetic field signal from the interrogator 12, the transponder 14 generates the reply signal having contained ID identification code  $\Delta A$  beforehand remembered to be magnetic-field-strength data  $\Delta B$  about the magnetic field signal in the control circuit 22, and it is constituted so that it may send a reply from the reply antenna 28.

[0049]And in the interrogator 12 by the side of the vehicles 11, Compare ID identification code  $\Delta A$  which receives the reply signal from the transponder 14 and is contained in the reply signal with ID identification code  $\Delta A$  memorized beforehand in the discrimination circuit 18, and. When both are in agreement, it is distinguished whether based on magnetic-field-strength data  $\Delta B$ , the intensity of the magnetic field signal which the transponder 14 received has reached the predetermined intensity level.

[0050]It is constituted so that the reply signal from the transponder 14 may be received, by the time it transmits the following magnetic field signal, after the interrogator 12 transmits a magnetic field signal at this time. Thereby, the interrogator 12 can identify whether the reply signal from the transponder 14 is a thing corresponding to the magnetic field signal from which antennas 15-17. Therefore, also in this example, the same operation effect as the 1st example of the above can be obtained.

[0051]Expansion or change which it is not limited to the above-mentioned example and described below is possible for this invention. The reply signal from the transponder 14 is good also as not only a radio wave signal but a magnetic field signal, or a lightwave signal. Although the receiving antenna 23 and the reply antenna 28 were separately formed in the transponder 14, respectively, it is good also as the same antenna.

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3.In the drawings, any words are not translated.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]The functional block diagram in which showing the 1st example of this invention and showing the composition of the whole system

[Drawing 2]The figure showing typically arrangement of the antenna by the side of vehicles, and the transponder built in the ignition key

[Drawing 3]The figure showing the contents of the reply signal over the signal waveform diagram of a magnetic field signal and magnetic field signal from an interrogator

[Drawing 4]The drawing 3 equivalent figure showing the 2nd example of this invention

[Description of Notations]

the inside of a figure, and 11 — vehicles and 12 — an interrogator and 14 — P antenna (antenna for magnetic field generating) and 17 show a T type antenna (antenna for magnetic field generating), 23 shows a receiving antenna, and, as for D antenna (antenna for magnetic field generating), and 16, a transponder and 15 show a locking mechanism 31.

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[Translation done.]

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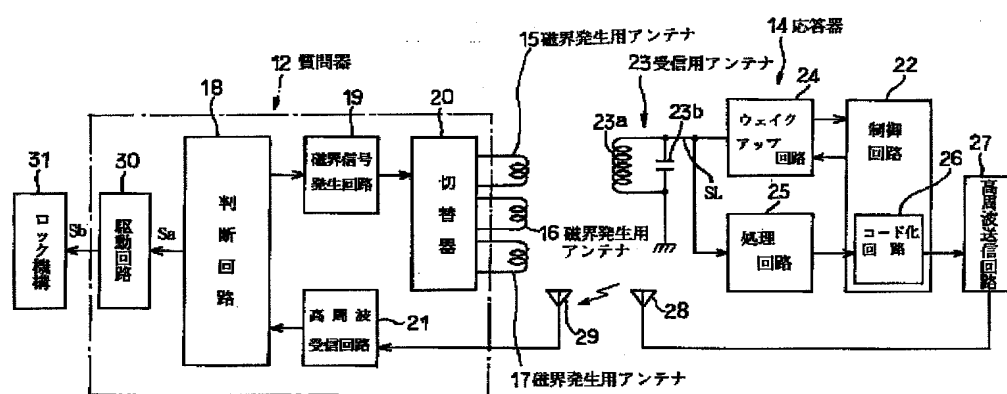
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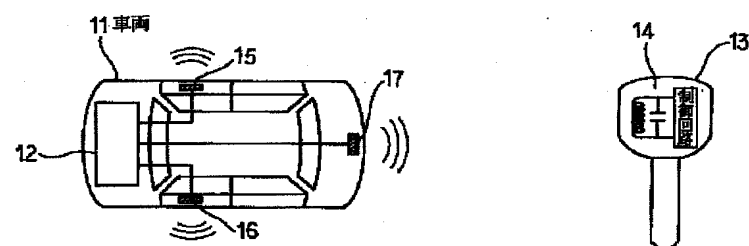
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DRAWINGS

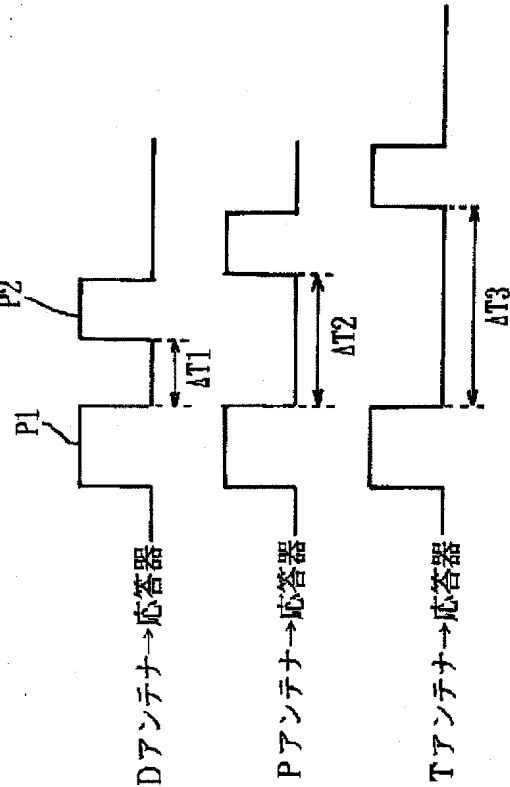
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Drawing 4]

応答器→質問器					
ID識別 コードΔA	D7デタからの 識別データΔB	P7デタからの 識別データΔB	T7デタからの 識別データΔB		

